A Novel Approach for a Hostile Arms Fire Sensor

Joseph Rudy Montoya, PhD and Jorge Melchor
US Army Research Laboratory-SLAD
White Sands Missile Range, NM

Venu Siddapureddy and Darryl Bryk
US Army RDECOM-TARDEC
Warren, MI

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Issue and Objective

VEA
VEHICLE ELECTRONICS AND ARCHITECTURE

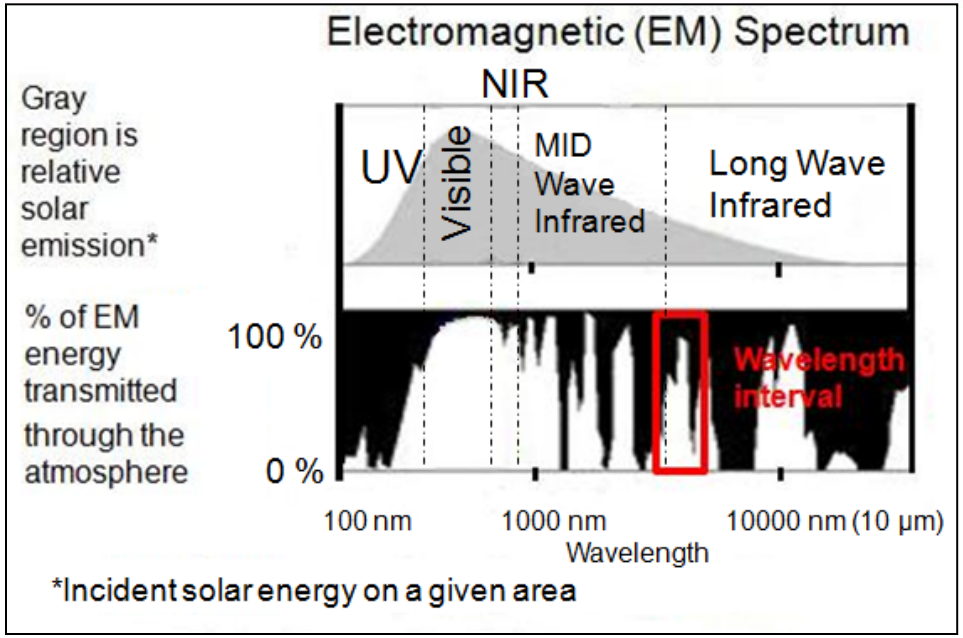
Issue:

- Utilizing the multispectral properties of the electromagnetic spectrum , sensor methodology has been tested very successfully in detecting point of origin of various types of arms fire. In-theatre travel in caravans has drawn enemy fire with urban settings making it difficult to discern point of origin. This new multispectral methodology may overcome false alarm problems that can plague other types of sensors.

Objective:

- Show multispectral approach.
- Example of a multispectral imaging system.

Multispectral Defined



- The EM spectrum has been partitioned into general regions that have common characteristics, which are ultraviolet (UV), near-infrared (NIR), visible, mid-wave infrared (MWIR) and long wave infrared (LWIR).
- Multispectral is the use of multiple separate wavelength intervals. These wavelength intervals have characteristics that are wavelength dependent such as but not limited to solar emission and atmospheric transmission.
- Wavelength intervals can be in one or multiple EM regions.

Multispectral Methodology for Detection

- Multispectral methodology is the exploitation of useful wavelength-dependent characteristics. This exploitation can be within one single or multiple EM regions.

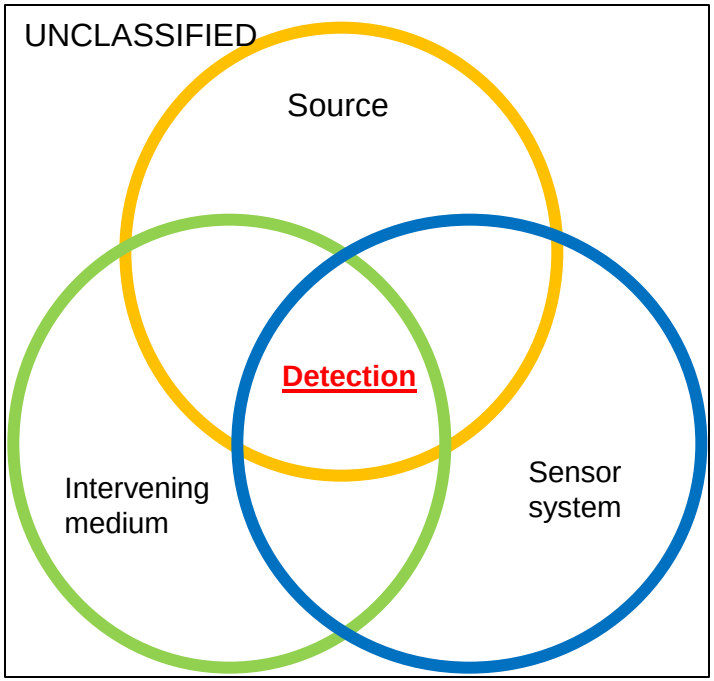
- Each EM region has its own sensor technology and the use of multiple regions in a multispectral methodology will generally increase exploitation complexity.

- Solar emission, which is wavelength dependent, is the leading cause of false detection.

- False detection will be mitigated by the application of multispectral methodology.

Electromagnetic (EM) region	**Transmission through medium**	**Sensor**
Ultraviolet (UV)	Poor	**No solar emission observed**
Visible/ Near Infrared (NIR)	**Good**	**Low cost**, solar emission observed
Mid Wave Infrared (MWIR) and Long Wave Infrared (LWIR)	**Very Good**	Expensive, solar emission observed

Detect Threat Using Multispectral Methodology



TRADE SPACE

Source is launch flash. The energy released or radiant intensity is wavelength dependent.

Transmission through **intervening medium** such as obscurants and atmosphere are wavelength dependent.

The spectral response of a **sensor system** is wavelength dependent.

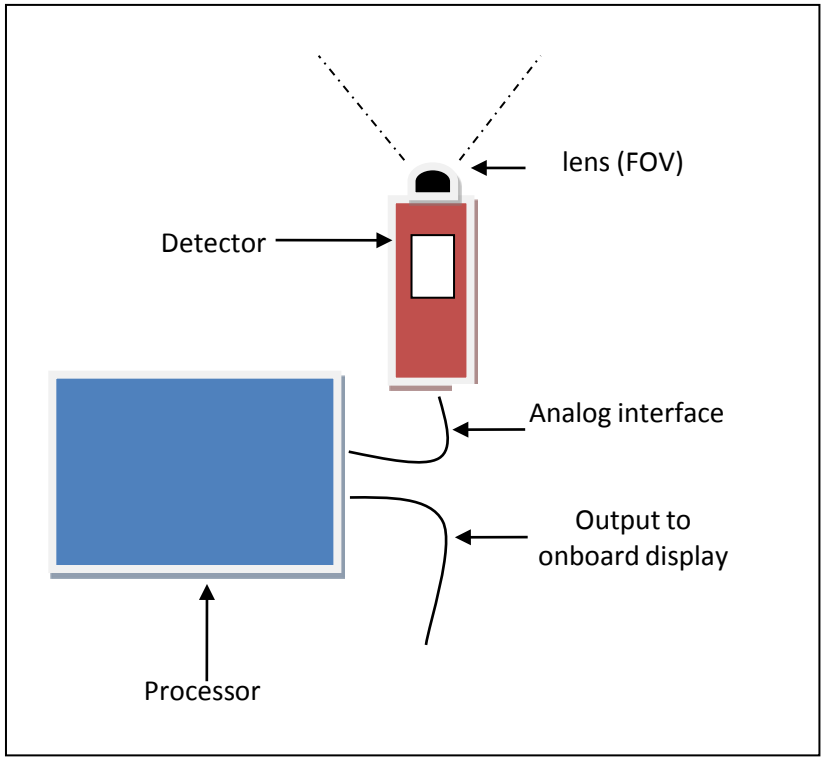
Using the trade space including, source, intervening medium, and sensor system may provide a solution for detection of a threat launch event. For example, applying the multispectral methodology hostile fire.

Multispectral Imaging System

Typical parameters of a notional multispectral imaging system

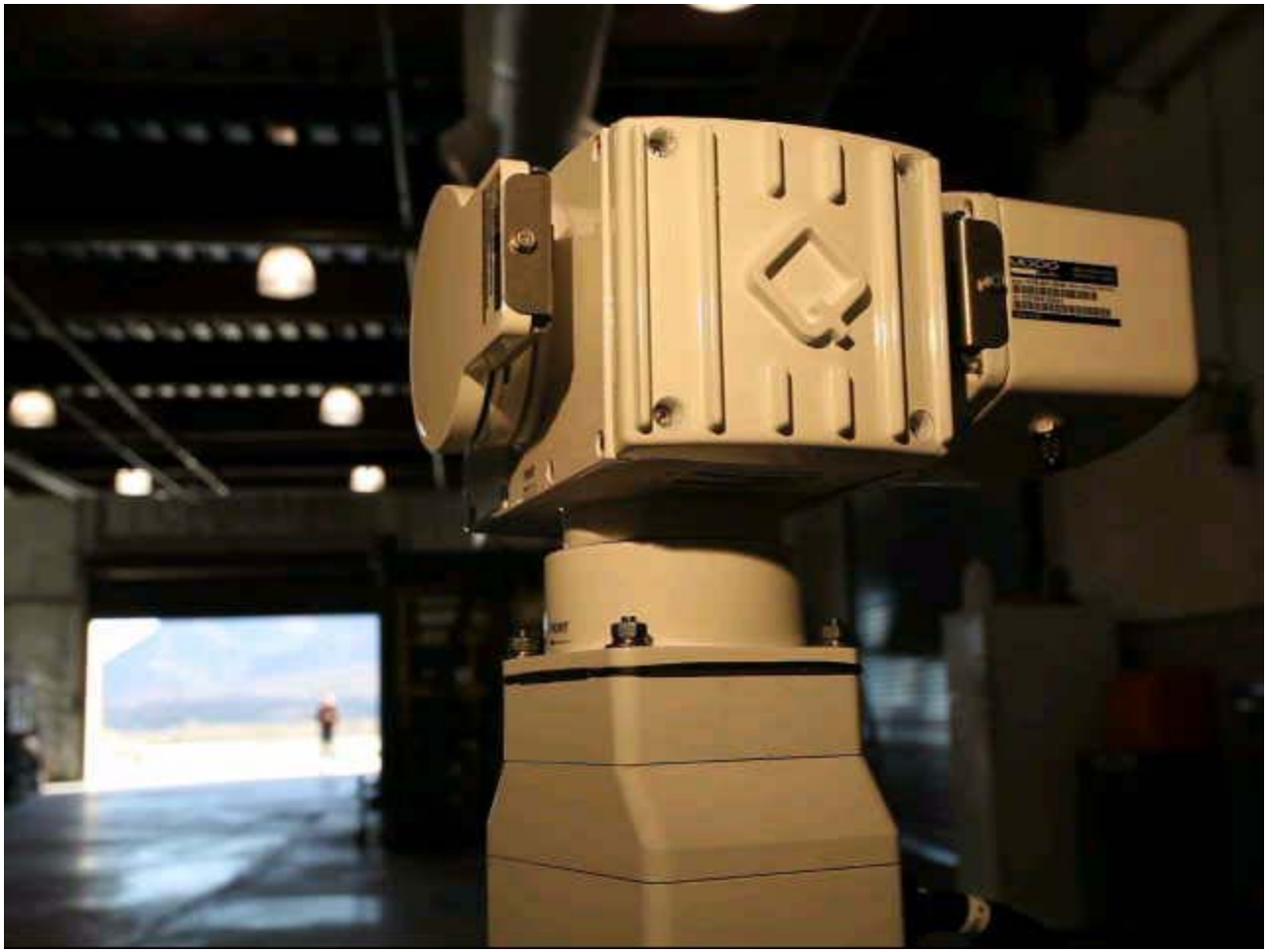
- Processor module - 4 ft x 3 ft x 1 ft, weight 25lbs
- Sensor module - 3 ft x 1ft x 0.5ft, weight of 5lbs.

- ISSUES:
  - ICD – Communication protocols
  - Size, weight and power (typical power usage is <5 amps)
  - Multispectral system may need large data storage, extensive data processing capability.



Multispectral Device Slewing a Tracker

Tracking device slews to follow a lit match (target)



Sensory System Integration Issues

Vehicle platform and system issues:

- Sensor system merits
- Technology readiness level (TRL)
- MIL standards certification
- Mechanical, electrical, and data interfaces
- Threat messages with range, elevation, and azimuth
- System interface with Remote Weapons Station
- Processing requirements
- System built using open data architecture standards, modular system configuration
- Development kit for ease of integration and testing

Conclusion

- Long range detection
- False alarm rate is low
- Faster detection time than an acoustic signal due to detection in the electromagnetic spectrum
- Production price is less than current fielded systems
- Ease of data integration to vehicular system due to open system development
- Modularity in design will allow configuration to many vehicle platforms